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REVIEW

Emergence of antibiotic resistance amongst hospital-acquired urinary tract infections and pharmacokinetic/pharmacodynamic considerations

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Summary Bacterial urinary tract infections (UTIs) are frequent infections in the nosocomial setting. Nosocomial UTIs are almost exclusively complicated UTIs, although the complicating factors may be very heterogenous. The bacterial spectrum of nosocomial UTIs is broad and antibiotic resistance is common. The results of international and national surveillance studies on the bacterial spectrum and antibiotic resistance of nosocomial uropathogens are provided. The treatment of nosocomial UTIs encompasses treatment of the complicating factors as well as antimicrobial chemotherapy. At least in serious UTIs, adequate initial antibiotic therapy results in lower mortality. Therefore, the initial antibiotic regimen must provide sufficient antibiotic cover. However, this can only be achieved if the bacterial spectrum and antibiotic resistance patterns of uropathogens in the institution are followed continuously. Provisional microbiological findings, such as reports on Gram stain or certain biochemical results, can lead to early stratification of pathogens and allow more tailored empiric antibiotic therapy. Antibiotic therapy of nosocomial UTIs has to consider two different aspects: (1) therapeutic success in the individual patient; and (2) prevention of emergence of antibiotic-resistant mutants. The emergence of resistance can possibly be lowered by adequate drug selection and dosing. Increasing antibiotic resistance requires more prudent use of antimicrobial drugs.

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Introduction

Nosocomial urinary tract infections (UTIs) account for at least 40% of all nosocomial infections and are mainly associated with catheters.[1-3] Nosocomial bacteriuria develops in up to 25% of patients requiring a urinary catheter for seven days or more, with a daily cumulative risk of 5%.[3] It has been estimated that an episode of asymptomatic nosocomial bacteriuria adds $500–1000 to the direct cost of acute-care hospitalization.[4] In addition, the pathogens involved are fully exposed to the nosocomial environment, including antibiotic pressure, foreign bodies or altered growth conditions. Therefore, nosocomial UTIs comprise perhaps the largest institutional reservoir of nosocomial antibiotic-resistant pathogens.[3]

Bacterial spectrum

Whereas community-acquired UTIs are often uncomplicated, almost all nosocomial UTIs are complicated infections with structural or fuctional abnormalities within the urinary tract, such as indwelling catheters or some form of urinary obstruction. The bacterial aetiology of UTIs differs markedly between uncomplicated and complicated UTIs.

Bacterial spectrum in complicated, hospital-acquired UTIs

The bacterial spectrum of complicated, nosocomial UTIs is heterogenous and comprises a wide range of Gram-negative and Gram-positive species. The bacterial spectrum can vary geographically, over time and between distinct specialities at the same institution.[5]

Bacterial spectrum of nosocomial UTIs in North America (SENTRY study) (Table I)

The SENTRY antimicrobial surveillance programme, initiated in 1997 and still ongoing, has chronologically examined urinary pathogens collected from hospitalized patients from different hospital departments across North America, and thus provides insight into pathogen frequency and resistance rates.[6] A surveillance study based on 1998 data encompassed 31 North American institutions which examined 1510 urinary isolates from hospitalized patients from different departments. Approximately 25% of these isolates were hospital-acquired strains, of which 20% were isolated from intensive care units.[7]

Bacterial spectrum of nosocomial UTIs in Europe (ESGNI-003 study) (Table I)

A European multi-centre one-day prevalence study on nosocomial UTIs of patients from different hospital departments tested 607 uropathogens from 228 hospitals throughout Europe.[8] Patients from different departments throughout the hospital were evaluated.

Bacterial spectrum of nosocomial UTIs in urological patients in Europe (PEP study) (Table I)

A European multi-centre one-day prevalence study on nosocomial UTIs in urology tested 320 uropathogens from 232 urological departments throughout Europe.[9]

Bacterial spectrum of UTIs in hospitalized urological patients in Straubing, Germany over a 10-year period (Tables I and II)

Since 1994, ongoing longitudinal surveillance on nosocomial uropathogens has been undertaken at our urological institution.[10,11] The species isolated are shown in Tables I and II. Only one isolate of one species with the same susceptibility pattern from each patient was included in the study to avoid duplicates.

Antibiotic resistance in complicated, hospital-acquired UTIs

Nosocomial uropathogens are frequently subject to antibiotic pressure and cross-infection.[10] The influence of these parameters can vary between regions and specialities. Different species of uropathogens show distinct abilities to develop antibiotic resistance.